(*b*) **Byproduct coke oven:** In this process coal is heated in combustion chambers, separate from carbonisation chambers. The thermal efficiency has been increased and the valuable byproducts are recovered. The coke ovens are made of silica bricks and the temperature is about 1350°C to 1450°C. The batch process is made continuous by building ovens in a battery. The oven consists of number of narrow silica chambers (10 m × 3 m × 0.4 m) erected side by side with vertical flues in between them. There is a charging hole at the top, a gas off take and a refractory lined cast iron door at each end. It is heated externally by a portion of coal gas produced by the process itself or by producer gas or by blast furnace gas.

Highlights:

- There are two main types of coking of coal:
  (*i*) Beehive and the (*ii*) by product coking.
- Beehive coking is obsolete. It is a batch process causing a large amount of pollution. A portion of coal is burnt inside the retort to generate heat for coking.
- In byproduct coking, air is excluded so that no burning takes place within the oven, heat is supplied from the hot flue gases and 40% of the oven gas (coal gas) generated is burnt to heat the battery of ovens and the rest is used for domestic fuel locally.

Finely crushed coal is charged through the hole at the top and in a closed system it is heated to 1200°C. The flue gases produced during combustion pass their sensible heat to the checker brick-work, which is raised to 1000°C. The flow of heating gases is then reversed and the hot checker bricks heat the inlet gas. This cycle continues till the volatile matter lasts. Carbonization takes about 11 to 18 hours, after which the doors are opened and the glowing coke mass is discharged by machine driven coke-pusher into coke-quencher. The hot coke is quickly quenched by water spraying. 'Dry quenching' is also done by circulating flue gases over hot coke and the hot gases are utilised to run waste heat boilers (Fig. 18.4).

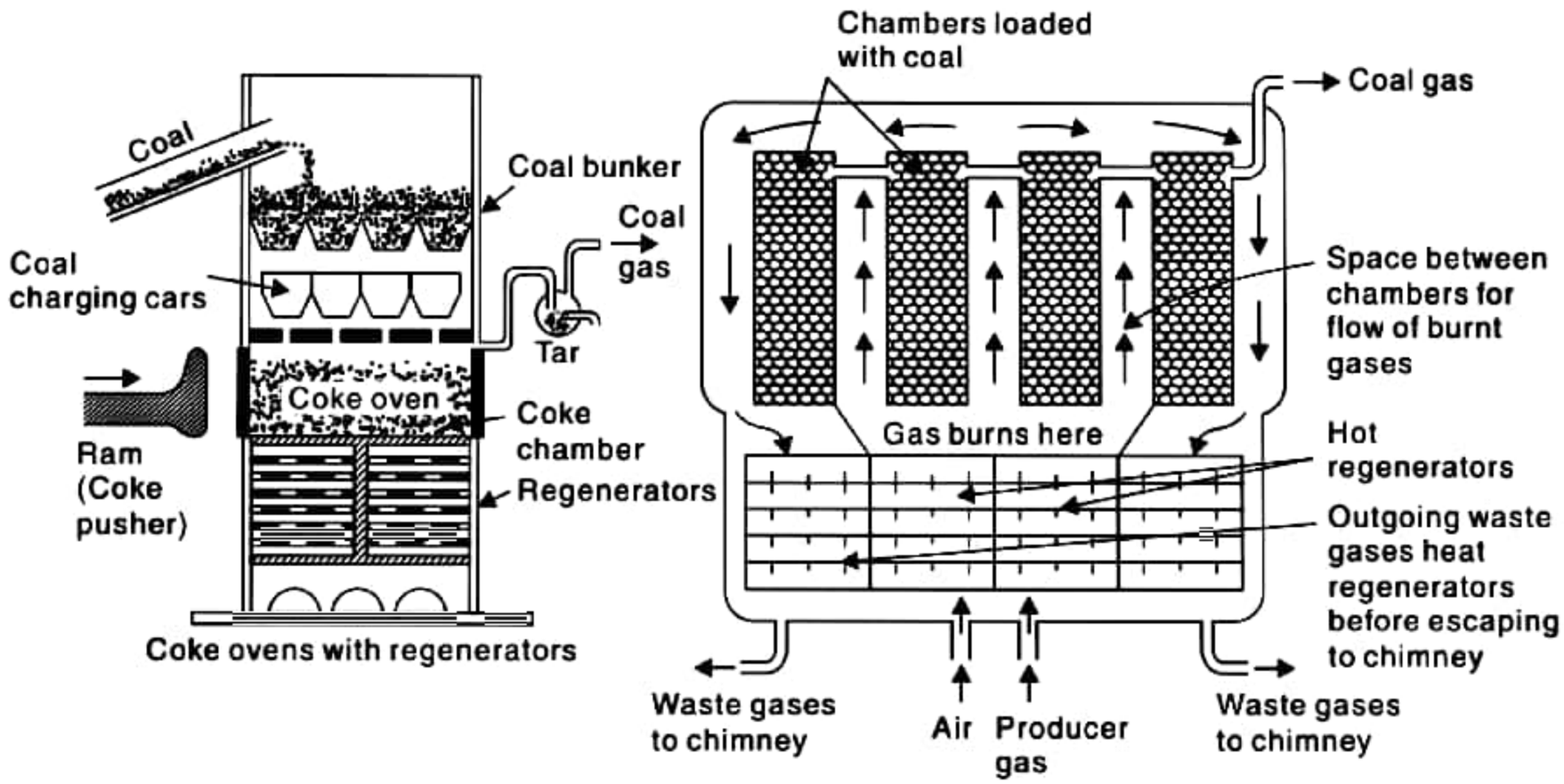

Fig. 18.4 Otto Hoffman's byproduct coke oven with regenerators.

Recovery of byproducts: The gases coming out at 600°C–700°C get a spray of flushing liquor at the goose-neck of the standpipe and the temperature is reduced to 80°C. Tar and steam get condensed. The 'Coke oven gas' is composed of NH_3, H_2O; tar contains naphthalene, benzene, moisture etc.

(*i*) Coal tar is condensed in the tank below.

(*ii*) Ammonia is recovered partly as aqueous solution and partly as sulfate.

(*iii*) Naphthalene is recovered by passing the gas through a tower where water is sprayed at very low temperature which condenses the naphthalene.

(*iv*) Benzene is recovered similarly by spraying petroleum.

(*v*) H_2S is recovered by passing the gas through moist Fe_2O_3 as:

$$Fe_2O_3 + 3H_2S \longrightarrow Fe_2S_3 + 3H_2O$$

Fe_2S_3 is again regenerated by exposing to atmosphere

$$Fe_2S_3 + 4O_2 \longrightarrow 2FeO + 3SO_2$$

$$4FeO + O_2 \longrightarrow 2Fe_2O_3$$

Beehive ovens are located in Jharia, Raniganj, Bokaro-Ramgarh in large numbers in India whereas byproduct coke ovens are on large numbers in Giridih, Durgapur, Jamshedpur, Bhilai, Rourkela, Bokaro etc.